REVIEW ARTICLE/*ARTYKUŁ POGLĄDOWY*

One of the giants of neurological surgery left us more than a decade ago, and neurosurgical literature did not show much interest

Jeden z gigantów neurochirurgii odszedł od nas ponad dekadę temu, a w literaturze neurochirurgicznej nie poświęcono mu większej uwagi

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Abstract

One of the giants of neurological surgery left us over a decade ago. Charles George Drake died September 15, 1998 in London, Ontario after an extended bout with lung cancer. Although he will always be identified with taking posterior fossa aneurysm surgery from the realm of the daring to the domain of the routine, his contributions were much broader. Clinical neurosciences have been blessed in the past century by the life and works of Drake. In the neurosurgical world, the achievements of Drake are very well known and have been well recorded. Unfortunately, in the past decade since his passing, only one paper has been published about him and his contributions to neurosurgery. This is a historical paper regarding Charles George Drake that attempts to (1) remember Drake as a pioneer; (2) to evaluate lessons that we have learned from him; and (3) to address the question 'What made him great?'. As per Drake's teachings, this paper is meant to articulate the unique perspectives Charlie provided with respect to how we learn our craft, maintain the integrity of reporting, and implement suggestions as to how we may progress into the future. In conclusion, it is our hope that this paper will bring to life

Streszczenie

Charles George Drake, jeden z gigantów neurochirurgii, zmarł przed ponad 10 laty. Chociaż jego nazwisko będzie zawsze kojarzone z wprowadzeniem do praktyki chirurgicznego leczenia tętniaków tylnego dołu czaszki, wkład Drake'a w neurochirurgię jest znacznie szerszy. Niestety, w ciągu dekady od jego odejścia opublikowano tylko jeden artykuł poświęcony jego życiu i wkładowi w neurochirurgię.
Niniejszy historyczny artykuł dotyczący Charlesa George'a Drake'a podejmuje próbę upamiętnienia go jako pioniera, poddania ocenie pozostawionej przez niego spuścizny i odpowiedzi na pytanie, co uczyniło go wielkim.
Mamy nadzieję, że artykuł ten przybliży środowisku neurochirurgów wyjątkowy charakter Drake'a i cechujące go bezprzykładne połączenie geniuszu, kreatywności, sprawności technicznej, wglądu i nieodłącznej skromności.

Słowa kluczowe: Charles George Drake, neurochirurg, gigant.

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the unique character of Drake and his unprecedented blend of genius, creativity, technical skill, introspection, and ever-present humility for all international neurosurgeons to appreciate.

Key words: Charles George Drake, neurosurgeon, giant.

Introduction

Charles George Drake is widely known as the most famous Canadian neurosurgeon. He was challenged with the complexities of treating ruptured cerebral aneurysms in the late 1940s, especially aneurysms in difficult locations such as that of the vertebrobasilar system. His skill as a surgeon and his leadership in his profession were such that he was known as a person of exceptional abilities throughout the neurosurgical world. Drake made lasting contributions to neurosurgery even up until just a few weeks before his death. He died of a massive pulmonary embolus on September 15, 1998, a complication of lung cancer, in London, Ontario. His last four studies appeared after his death [1-4].

The discipline of cerebrovascular surgery is a young and dynamic field. Charles George Drake played a significant role in the development of new techniques and devices that would ultimately result in decreased mortality rates and improved results of the complex cerebrovascular procedures. Even as late as the 1960s, many neurosurgeons doubted the effectiveness of aneurysm surgery. To a significant extent, this sceptical outlook was based on some of the less successful outcomes reported in several series of aneurysm patients. Historically, the poor outcome associated with conservative therapy prompted neurosurgical pioneers to use Hunterian ligation – complete ligation at first, followed by the transitional practice of gradual occlusion. Currently, patients undergoing aneurysm surgery have a much lower risk of death or gross neurological morbidity through the persistence, curiosity, and courage of the many neurosurgical pioneers such as Charles George Drake. Both Drake and his ingenious tools and techniques have transformed the natural history of aneurysm progression from a once discouraging and lethal vascular pathological entity into a mostly curable neurosurgical lesion. This is a historical paper regarding Charles George Drake that attempts to (1) remember Drake as a pioneer; (2) evaluate lessons that we have learned from him; and (3) address the question 'What made him great?'.

General biographical information

Charles George Drake was born in Windsor, Ontario, Canada, on July 21, 1920. He received his M.D. degree from The University of Western Ontario, London in 1944. He interned at Toronto General Hospital before returning to Western to instruct in physiology. He continued his studies in physiology at Yale University and returned again to London as a surgical resident at Victoria Hospital, and became a Fellow of The Royal College of Surgeons, Canada, in 1952. His first faculty appointment in 1952 coincided with the launching of his practice of neurosurgery. During his training in neurosurgery at the University of Toronto, he was greatly influenced by the renowned neurosurgeons E.H. Botterell and K.G. McKenzie [5]. After sojourns for extra neurosurgical experiences at the National Hospital, Queen's Square and at various other European teaching hospitals, he returned to become the first neurosurgeon in London, Ontario and he served as Clinical Professor of Surgery (Neurosurgery) at The University of Western Ontario until July, 1969, when he became Professor and Chairman of the new Department of Clinical Neurological Sciences. In 1974, he assumed the post of Professor and Chairman of the Department of Surgery at The University of Western Ontario.

Drake was recognized internationally by his peers for many years, was a member of 24 national and international medical societies, and held honorary membership in 10 foreign neurosurgical associations. He served as a member, and then Chairman, of the Editorial Board, *Journal of Neurosurgery* (1967-1976); Canadian Neurosurgical Society (President, 1966-1967); Southwestern Ontario Surgical Society (President, 1968-1969); Royal College of Physicians and Surgeons of Canada (President, 1971-1973); Canadian Association of Clinical Surgeons (President, 1971-1973); American Association of Neurological Surgeon (President, 1977-1978); World Federation of Neurosurgical Societies (President, 1977-1981); and President of the American College of Surgeons (1984-1985). In summary, he served as president of the Royal College of Physicians and Surgeons of Canada (1971-1973), the American

Association of Neurological Surgeons (1977), the American College of Surgeons (1984-1985), the World Federation of Neurological Societies (1977-1981), the Society of Neurological Surgeons (1980), and the American Surgical Association (1986-1987).

He retired in 1995.

Lessons that we learned from Drake

Drake graduated in 1944 from the Medical School of The University of Western Ontario, located in the small city of London, Ontario, Canada. Neither the school nor the city was well known for medical contributions at that time, let alone renowned. He was challenged with the difficulties of treating ruptured cerebral aneurysms in the late 1940s, especially aneurysms in the nearly impossible locations of the vertebrobasilar system. His first faculty appointment in 1952 coincided with the launching of his practice of neurosurgery.

Early on in his surgical career, his focus was directed towards improvement of the techniques needed to successfully treat aneurysms of the posterior fossa. Arteriovenous malformations (AVM) and giant aneurysms were soon part of his focus because they also presented often as an unsolved and daunting challenge. It was a privileged experience to be within the same institution and department and observe at first hand, albeit from the gallery, the development and utilization of the pioneering techniques he applied to previously desperate problems. Patients were referred from the four corners of the world in numbers such that Barnett wrote about his recollection of one particular day when Drake operated successfully upon three individuals afflicted with basilar artery aneurysms. Not many would have the stamina let alone the skill to accomplish this tour de force [6].

What made him great?

To address this question is no easier than to answer such a question about others. Few extraordinary individuals in the field of neurosurgery surpass the accomplishments of their peers. Why do such individuals as Drake stand above the crowd? There is no simple answer, of course, but all of them, including Drake, had instinctive inquisitiveness and the tenacity to obtain uncompromising results which might be attributed to sheer genius. One thing is for sure: they all exhibited a dedicated and indeed relentless focus and drive. Drake never let a problem remain unresolved in his mind nor allowed it to be pushed aside by other matters until decisions had been made and appropriate action taken. If his skills could not master a problem he kept coming back to it in his discussions with colleagues and in his own reflections. Then he carefully planned his actions until improvements had emerged in his abilities to cope with the situation. Before his retirement in 1995, his surgical skills contributed to the neurosurgical intervention of 1767 patients afflicted with posterior fossa aneurysms and malformations [6]. Barnett reported that Drake never spoke ill of others. Instead of complaining about everyday unpleasantries and irritations, he just 'went quiet'. Always, he took the high road and his integrity was legendary [6].

In 1964, Drake and colleagues reported on ten patients undergoing hypothermic circulatory arrest for the treatment of intracranial aneurysms. The authors attributed three deaths (30%) to the use of this technique, with postoperative coagulopathy especially responsible. Furthermore, technical problems occurred because of poor venous return when using cannulas in the superior and inferior venae cavae. This was the first report of poor results and was partly responsible for the decline in the use of this technique, as Drake recounted later [7].

As the success with basilar, other aneurysms and other haemorrhagic diseases expanded and became well known, there were numerous patients referred to Drake from all over the world. The 'gold standard' for the basilar, subtemporal approach was established and introduced by Drake [8]. His full record of vertebral-basilar aneurysms was published in 1995 [9].

In his 1979 series of 166 patients with cerebral AVMs, Drake included two cases of nongalenic arteriovenous fistulas (AVFs) associated with huge varices. Although five AVMs in this series were treated with flow-directed or direct selective plastic bead embolization, this type of procedure was not an option for nongalenic AVFs, given the dangers posed by the AVFs' high flow and associated massive varix. The two patients with nongalenic AVFs in Drake's series underwent surgical clip occlusion of feeding arteries. This was a success in one patient, but the other patient died 24 hours after the operation due to intracerebral haemorrhage attributed to haemodynamic alteration. In this case, death resulted from haemorrhage; the venous outlet of the AVF was not surgically occluded during the operation, and later autopsy confirmed the patency of the varix. The varix collapsed on itself after Drake occluded the solitary large feeding artery of the AVF (in this case with a single clip).

Drake hypothesized that the cause of haemorrhage was rupture of a deep normal artery [10].

The Drake fenestrated aneurysm clip

The development of the Drake fenestrated aneurysm clip is a study in the history of ideas. This communication outlines the conception and solution of a surgical problem involved with the clipping of large basilar tip aneurysms. Drake's ability to modify old ideas and experiment with new ones was instrumental to the conceptual idea of a fenestrated clip. Dr. Frank H. Mayfield and Mr. George Kees, Jr. played essential roles in bringing the idea to reality. Drake worked with Mayfield to develop a fenestrated clip through which the posterior cerebral artery could pass, thus facilitating occlusion of basilar terminus aneurysms. Tew reported that Mayfield received a call from Drake, who was having difficulty operating on a basilar aneurysm. That night, Mayfield and Kees worked together in the laboratory, designing and making the modification, and shipped the clip to Drake. That clip was named the 'Drake fenestrated clip' [11].

The development of the fenestrated clip has added substantially to the armamentarium of the aneurysm neurosurgeon in dealing with large and complex aneurysms [12].

Today, the traditional notion of aneurysmal obliteration with microsurgical clipping is currently being challenged, with an evolving body of knowledge demonstrating that endovascular treatment may have lower mortalities and morbidities. It has been suggested that coiling should be considered as first-line treatment in aneurysmal subarachnoid haemorrhage and clipping should be restricted to cases where embolization is not feasible due to technical difficulties (e.g. inability to catheterize the common carotid artery, peripheral artery disease with femoral artery occlusion) and in the case of giant aneurysms, especially those located in the anterior circulation. Another point raised was the higher rebleeding and recanalization rate in the coiled arm of the study [13]. However, surgical clipping attempts to seal off the arterial wall defect, whereas coiling leaves a defect at the interface of the aneurysm and parent vessel. Aneurysms that are not completely coiled presumably are different from those that are, and this selection prevents attributing the apparent increase in risk of rupture only to the incompleteness of the procedure itself. Unless endothelialization of the aneurysmal orifice occurs, the aneurysm may be susceptible to repermeation and bleeding. Endothelialization can occur, but it is not the rule, particularly for wide-necked aneurysms. Aneurysm recanalization is an innate problem in endovascular treatment of aneurysms with coils. The results and successes documented by Drake [13] provide an important model with which endovascular and all other treatments can be compared. In addition, the clinical status of patients with neurological disturbances after surgical treatment of ruptured intracranial aneurysm improved in 92.7% of cases after rehabilitation treatment [14].

Conclusion

Drake's contributions to neurosurgery were numerous. Some of his studies appeared after his death [4,8,15]. His bibliography contained more than 120 scientific articles and chapters. Drake's skill as a surgeon and his leadership in his profession were such that he is remembered as a person of exceptional abilities throughout the neurosurgical world. He has left behind a legacy, largely as a result of his own endeavours. It seems that Drake's legacy inspires us to tap into our own creativity for advancing the field of neurosurgery. Today's neurosurgeons and their patients continue to benefit from the innovative work of Drake [16]. He was truly a pioneer, helping to usher in the modern era of neurosurgery. The world of neurosurgery will remain his debtor. He is fondly remembered and missed by many.

Disclosure

Authors report no conflict of interest.

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